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TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known. see 37 CFR 1.5) 09/762917

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US99/17611	August 4, 1999	August 14, 1998

OIPE FEB 13 2001 JC14? PATENT & TRADEMARK OFFICE

TITLE OF INVENTION

Apparatus and Method for Extracting Algorithmic Information From a Message Stream

APPLICANTS FOR DO/EO/US

Collins

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(C)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(C)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A FIRST preliminary amendment.
    ☐ A SECOND OR SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
    Copy of PCT Notice Form PCT/IB/308
    Copy of International Search Report
    Copy of Published International Application
    Copy of the IPER
    Formal Drawings (4 sheets)
    Patent Application Data Entry Form

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17. ☒ The following fees are submitted:	CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a)(1) – (5)):		
Neither international preliminary examination fee (37 CFR 1,482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$970.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$840.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1./445(a)(2)) paid to USPTO **$760.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$760.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) **$96.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$840.00	
Surcharge of **$130.00** for furnishing the oath or declaration of later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$0.0	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	20 – 20 =	0	X **$18.00**	$0	
Independent claims	4 – 3 =	1	X **$78.00**	$78.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$260.00**	$0	
			TOTAL OF ABOVE CALCULATIONS =	$918.00	
Reduction of ½ for filing by small entity, if applicable. A Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28)				**$0**	
			SUBTOTAL =	$918.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$0	
			TOTAL NATIONAL FEE =	$918.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ 0	
			TOTAL FEES ENCLOSED =	$918.00	
			Amount to be: refunded	$	
			charged	$	

a. ☒ A check in the amount of $918.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 20-0531. A duplicate copy of this sheet is enclosed.

NOTE: When an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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REGISTRATION NUMBER

2027402-1

APPARATUS AND METHOD FOR EXTRACTING ALGORITHMIC INFORMATION FROM A MESSAGE STREAM

Field of the Invention

The present invention relates to data communication apparatus and methods and, in particular, to apparatus and methods for extracting algorithmic information from a stream of messages so that a message stream containing algorithmic information may be transmitted more efficiently.

Background of the Invention

Distributed computer systems, in which a client node is typically remote from a server, utilize the technique of distributing execution of an application. More specifically, an application server provides application execution services, such as application processing or access to files and other resources, to client nodes instead of the client nodes providing those services. Client nodes are generally cheaper than servers, and since one server typically provides services to more than one client, overall system cost is reduced. Additionally, client-server systems allow decisions regarding the location of certain system resources (such as applications) to be made on a situational basis. Unfortunately, the amount of bandwidth required to transmit graphical user interface elements can easily exceed the bandwidth provided by relatively high bandwidth transport mechanisms such as Ethernet.

The growing collection of networked computers commonly referred to as "the Internet" allows a natural and compelling extension of the flexibility and power provided by client-server, distributed systems. In this extension, any "node" may act as a client that receives application output from a remote "server." Unfortunately, the relatively low bandwidth of Internet connections exacerbates the bandwidth consumption problems described above and makes widespread use of such a system problematic, even with traditional data compression techniques.

Summary of the Invention

The present invention allows a message stream to be decomposed by a transmitting node into one or more sub-streams by a transmitting node and regenerated by a receiving node so that the total network traffic between the two nodes is less than would be required to transmit the message stream in the first instance. One of the sub-streams represents algorithmic information, that is, some portion of the message stream represents repetitive or recurring strings or data values. Another sub-stream represents parameter information, which is data that does not repeat or recur throughout the message stream. Traditional compression techniques may be applied to the sub-streams to further reduce the amount of bandwidth necessary to communicate them between nodes.

In one aspect, the present invention relates to a method for extracting algorithmic information from a message having associated arguments. Each argument has an associated value. The message is identified as algorithmic information. The first time the value of an argument is encountered, it is identified as parameter information. Each subsequent time the value of the argument is encountered it is identified as algorithmic information.

In another aspect the present invention relates to a method for extracting algorithmic information from a message having associated arguments, each argument having an associated value. The extracted information is transmitted from a server to a remote client. The method includes the step of identifying, at the server, a message as algorithmic information. A message identifier is stored in an algorithmic information list. At the server a value of an argument associated with the message is identified as parameter information the first time the data value is encountered. Each subsequent time the data value is encountered it is identified as algorithmic information and a value identifier is stored in the algorithmic information list.

In yet another aspect, the present invention relates to an apparatus for extracting algorithmic information from a message having associated arguments, each of the associated arguments having an associated value. The apparatus includes a transmitter in electrical communication with a network connection that transmits algorithmic information over the network connection. The apparatus also includes an extractor which separates a message into algorithmic information and value information. The algorithmic information is stored in an algorithmic sub-stream and the value information is stored in a parametric sub-stream. Both sub-streams are stored in a memory element.

In still another aspect the present invention relates to a system for extracting algorithmic information from a message having associated arguments. Each one of the associated arguments has an associated value. The extracted information is transmitted from a server to a client over a network connection. The system includes a client and a server. The client includes a receiver in electrical communication with the network connection that receives algorithmic information transmitted over the network connection. The server includes a transmitter in electrical connection with the network connection that transmits algorithmic information over the connection. The server also includes an extractor which separates a message into algorithmic information and value information. The algorithmic and value information is stored in a memory element.

Brief Description of the Drawings

The invention is pointed out with particularity in the appended claims. The advantages of the invention described above, and further advantages, may be better understood by reference to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a block diagram of a distributed computer system;

FIG. 2 is a flowchart of one embodiment of the steps taken to extract algorithmic information from a message stream;

FIG. 3 is a flowchart of the steps to be taken in one embodiment of a heuristic; and

FIG. 4 is a block diagram of an apparatus for extracting algorithmic information from a message stream.

Detailed Description of the Invention

FIG. 1 is a schematic diagram of a distributed computer system incorporating the invention. The system includes a server node 10 coupled to a transport system 12 (e.g., serial lines, telephone lines, a local area network, a wide area network, or a wireless communication medium). Although only one server node 10 is shown in FIG. 1, it is understood that more than one server node 10 may be provided. The application servers 14 provide application execution services to network client nodes 16. In some embodiments each server node 10 provides a single application server 14, instead of the multiple application servers 14 depicted in FIG. 1.

In some embodiments, the system described in FIG. 1 is a traditional client-server system operating over a local area network such as Ethernet, which provides a bandwidth up to

substantially 10 Megabits per second (Mbps). In other embodiments, the transport mechanism, such as a serial connection over twisted copper-pair wiring typical in connections between Internet nodes, provides low bandwidth. Client nodes 16 may be located remotely from application servers 14 and communicate at a rate of 56 Kilobits per second (Kbps). In certain of these embodiments the client nodes 16 and application servers 14 communicate at a rate of 28.8 Kbps. In further of these embodiments the client nodes 16 and application servers 14 communicate at a rate of 9.6 Kbps or 2.4 Kbps.

When a client node 16 wishes to run an application, the application server 14 intercepts the user interface data of the client node 16 (e.g., the display screen, keyboard, and mouse) and transmits/receives this data to/from a user program running at the client node 16. For applications in which the application server 14 intercepts a graphical user interface, the application server 14 intercepts and transmits various graphic elements such as lines, arcs, ellipses, or bezier curves. In some embodiments the application server 14 communicates graphical user interface data to a client node 16 using one or more messages. The techniques described below may be advantageously used with any protocol that results in a message stream between nodes, including but not limited to: the X Windows protocol; the Serial Line Interface Protocol; the Point To Point protocol; the Independent Computing Architecture (ICA) protocol, manufactured by Citrix Systems of Fort Lauderdale, Florida; the PostScript printing and display protocol; the QuickDraw protocol, manufactured by Apple Computer of Cupertino, California; or the Graphic Device Interface (GDI) protocol, manufactured by Microsoft Corporation of Redmond, Washington.

Table 1 below shows a message stream that may be sent from an application server 14 to a client node 16 to instruct the client node 16 to draw a rectangular graphic user interface element.

Table 1

draw_line (0,0,0,100)
draw_line (0,100,100,100)
draw_line (100,100,0,100)
draw_line (0,100,0,0)

In the example described above, the draw_line command instructs a client node 16 to draw a straight line from at a starting point to an ending point. The first draw_line command in Table 1

instructs a node to draw a line beginning at an x-y coordinate location of (0,0) and ending at an x-y coordinate location of (0,100).

Referring now to FIG. 2, the server 14 begins extraction of algorithmic data by getting the next logical element from the message stream (step 202). A logical element is any data in the message stream that has inherent meaning, such as the draw_line messages, the x coordinate location values, and the y-coordinate location values. The next logical element may be stored in a convenient memory element from which the server 14 retrieves it. For example, the server 14 may store messages as they are generated by an application and retrieve them later for processing. Alternatively, the server 14 may receive the next logical element and process it in "real-time." In these embodiments the server 14 may receive multiple logical elements at a time.

The server 14 may use any number of techniques to identify logical elements. For example, the server 14 may be configured with knowledge of the protocol used to generate the message stream. Such knowledge would allow the server 14 to easily identify messages and arguments associated with those messages. In one embodiment the server 14 maintains a look-up table containing all messages provided by the protocol. In this embodiment the server 14 identifies messages by comparing a logical element to the look-up table. Once a message has been identified, the server 14 can identify data values based on the parameters expected to accompany the message, e.g., two byte-long arguments may follow a particular message.

Once the server 14 has gotten the next logical element, the server 14 uses a heuristic to identify algorithmic data based on the type of logical element the server 14 is processing (step 204). For example, a message may always be determined to be algorithmic information. As another example, the most recently encountered y-coordinate values could be compared to determine if a simple, commonly occurring relationship between those y-coordinate values exists. If such a relationship exists, then the y-coordinate value is identified as algorithmic information. In general, the function of the heuristic is to express a type of data value algorithmically as some function of the previous occurrences of the data value in the message stream. Examples of such relationships include, but are not limited to, that the most recently received y-coordinate value: is equal to the last encountered y-coordinate value; is one greater than the last received y-coordinate value; or is equal to the last received value plus a small delta.

The algorithmic encoding for the element is placed into an algorithmic sub-stream (step 206), even if the encoding specifies that no relationship could be identified. The algorithmic sub-stream stores the algorithmic data identified by the server 14. In one embodiment the

algorithmic sub-stream comprises a stack memory structure. In other embodiments, the algorithmic sub-stream is provided as a portion of random access memory. The algorithmic sub-stream may also be provided as a doubly-linked list, a singly-linked list, a queue memory structure, or an array.

The heuristic should also define the meanings of any algorithmic encodings it places into the algorithmic sub-stream. That is, the server 14 and client node 16 must both understand what a particular algorithmic encoding represents so that the client node 16 is able to reverse the extraction process. Thus, the encodings placed in the algorithmic sub-stream identify the formula or algorithm that can be used by the client node 16 to reconstruct the message stream. Using the message stream of Table 1 as an example, the first three coordinate locations encountered by the server 14 have a value of zero. The second and third coordinate value locations may be represented in the algorithmic sub-stream by an encoding identifying them as having the same value as the first coordinate value.

If the algorithmic encoding does not fully define the data value of the logical element (step 208), parameter information is placed in the parameter sub-stream (step 210). The parameter information is the residual information necessary to regenerate the data value. For example, in a case where the algorithmic data indicates that no algorithm for expressing the data value could be identified, the actual data value must be added to parametric sub-stream. In another example, if an algorithmic encoding is placed in the algorithmic sub-stream indicating that current data value is the same as the immediately previous data value plus a small delta, the value of the small delta must be placed in the parametric sub-stream.

The server 14 determines if there are more logical elements of the message stream to process (step 212). For embodiments in which the message stream is stored in a memory structure, this may be done by checking to see if the memory is empty or if the end of the particular memory structure has been reached. For embodiments in which messages are received as they are generated, a message may include some information that signals it is the last message. If more messages remain to be processed, then the server 14 gets the next logical element in the message stream (step 202). If not, then the server 14 is done (step 214). For embodiments in which the server 14 receives messages as they are generated the server 14 may, in step 214, wait to receive new messages using some form of looping or interrupt mechanism.

Once the server 14 has constructed the algorithmic and parametric sub-streams, those sub-streams are transmitted to the client node 16. The client node 16 reconstructs the message

stream by using each formula from the algorithmic sub-stream. The client node 16 uses each formula to regenerate the values of the logical items in the message stream, consuming data values from the parametric sub-stream as directed by the formulae.

In one embodiment the algorithmic and parametric sub-streams may be further compressed before transmission to the client node 16. An exemplary compression algorithm that could be used to further compress the sub-streams is Lempel-Ziv-77 and its derivatives. In other embodiments the server 14 stores the sub-streams it transmits to the client node 16 in a buffer and the client node 16 stores the sub-streams received from the server 14 in a buffer. In this embodiment, the server 14 compares a sub-stream to the server buffer before transmitting the sub-stream to the client node 16. If the sub-stream matches an entry in the buffer, then the server 14 has previously transmitted the sub-stream to the client node 16. The server 14 transmits a glyph to the client node 16 that indicates the starting point in the buffer and length of the match instead of the sub-stream itself. An alternative compression technique which may be used is described in United States Patent Application Serial No. 09/084,838, filed May 26, 1998, the contents of which are incorporated herein by reference.

Referring now to FIG. 3, a particular heuristic for separating algorithmic data and parametric data will be discussed. The particular heuristic depicted by FIG. 3 is particularly suited for algorithmic data extracted from a message stream composed of drawing commands, such as the message stream shown in Table 1. In this embodiment, the server 14 gets the next logical element in the message stream (Step 202, FIG. 2) and determines if the logical element is a message (step 302). The server 14 can determine if the logical element is a message by comparing the element to a look-up table containing a representation of all messages provided by the protocol. Alternatively, messages may be indicated by a bit or flag embedded in the message stream. If the server 14 determines that the logical element is a message, the server inserts an algorithmic encoding identifying the message into the algorithmic sub-stream (step 308).

If the server 14 determines that the logical element is not a message, the element is a data value. The server 14 attempts to determine if this is the first time the data value has been encountered (step 304). If not, the data value can be represented as algorithmic data and an entry is placed into the algorithmic sub-stream (step 308) indicating that the current data value has been previously received. If, however, the current data value has never been received, then the server 14 places an algorithmic encoding into the algorithmic data stream indicating that a new

data value has been encountered (step 310) and the data value is placed into the parametric sub-stream (step 312).

Referring now to FIG. 4 an apparatus 40 for extracting algorithmic information from a message stream includes a transmitter 42, an extractor 44, a memory element 46 in electrical communication with the extractor 44 and the transmitter 42, and an optional compressor 48 (shown in phantom view). The extractor 44 operates on one or more messages to separate algorithmic data from parametric data. Extractor 44 may be in electrical communication with a memory element storing the messages (not shown). In other embodiments, the extractor 44 is in direct electrical communication with the source of the messages. Extractor 44 is in electrical communication with a memory element 46. The extractor 44 stores algorithmic sub-streams and parametric sub-streams in the memory element 46 for eventual transmission to a client node 16. Memory element 46 may be a structured memory element such as a stack or queue. Alternatively, memory element 46 may be provided as random access memory. If the memory element 46 is random access memory, it may be configured to provide a structured memory element for storing the sub-streams produced by the extractor 44. A transmitter 42 is in electrical communication with the memory element 46. The transmitter is also in electrical communication with a network connection (not shown) which allows it to transmit the algorithmic and parametric sub-streams produced by the extractor 44. The transmitter 42 drives the sub-streams over the network connection to a client node 16. The transmitter 42 may be one or more transceivers embodied as integrated circuits which connect to the network connection via a port. Alternatively, the transmitter 42 may be a stand-alone device such as a modem.

In some embodiments, the apparatus 40 includes a compressor 48 in electrical communication with the memory element 46 and the transmitter 42. The compressor 48 compresses the sub-streams stored in the memory element 46 before they are transmitted to a client node 16 by the transmitter 42. The compressor 48 may use any form of data compression such as Lempel-Ziv-77 and its derivatives.

The apparatus depicted in FIG. 4 may also be used to reconstruct the message stream. In this embodiment, the transmitter 42 is a transceiver capable of receiving sub-streams driven over the network connection. The transceiver 42 receives the sub-streams and stores them in the memory element 46. For embodiments in which compression is used, the transmitter 42 provides the received sub-streams to the compressor 48 which decompresses the compressed sub-streams and stores them in the memory element 46. Extractor 44 then reconstructs the

message stream using the algorithmic sub-stream and the parametric sub-stream stored in the memory element 46. Thus, a system may be provided in which servers 14 reduce message streams to one or more sub-streams and transmit those sub-streams over a network connection to a client node 16. The client node 16 receives the transmitted sub-streams and reconstructs the original message stream.

In some embodiments, the functionality described above may be implemented as software executing on a general purpose computer. For example, such a program may set aside portions of the computer's random access memory to provide the algorithmic and parametric sub-streams. Program logic may be used to effect the determinations described above. In such an embodiment, the program may be written in any one of a number of high level languages such as FORTRAN, PASCAL, C, C++, or BASIC. Additionally, the software could be implemented in an assembly language directed to the microprocessor resident on the target computer, for example, the software could be implemented in Intel 80x86 assembly language if it were configured to run on an IBM PC or PC clone. The software may be embodied on an article of manufacture including, but not limited to, a floppy disk, a hard disk, an optical disk, a magnetic tape, a PROM, an EPROM, EEPROM, field-programmable gate array, or CD-ROM.

Having described certain embodiments of the invention, it will now become apparent to one of ordinary skill in the art that other embodiments incorporating the concepts of the invention may be used. Therefore, the invention should not be limited to certain embodiments, but rather should be limited only by the spirit and scope of the following claims.

CLAIMS

What is claimed is:

1. A method for extracting algorithmic information from a message stream, each message having associated arguments and each argument having an associated value, the method comprising the steps of:

(a) identifying a message as algorithmic information;

(b) identifying the value of an argument as parameter information the first time the value is encountered; and

(c) identifying the value of the argument as algorithmic information each subsequent time the value is encountered.

2. The method of claim 1 wherein step (b) further comprises the steps of:

(b-a) identifying the value of an argument as parameter information the first time the value is encountered; and

(b-b) storing the identified value in an associated memory element.

3. The method of claim 2 wherein step (b-b) comprises storing the identified argument in a stack memory element.

4. The method of claim 1 further comprising the steps of storing a message identifier in an algorithmic sub-stream when a message is encountered and storing an argument identifier in the algorithmic sub-stream when a value of an argument is encountered subsequent to the first time.

5. The method of claim 2 further comprising the steps of storing a message identifier in an algorithmic sub-stream when a message is encountered and storing a value identifier in the algorithmic sub-stream when a value of an argument is encountered subsequent to the first time, the value identifier comprising the location of the value in the associated memory element.

6. A method for extracting algorithmic information from a message stream, each message having associated arguments and each argument having an associated value, and transmitting the extracted information from a server to a remote client, the method comprising the steps of:

(a) identifying, at the server, a message as algorithmic information;

(b) storing a message identifier in an algorithmic sub-stream;

(c) identifying, at the server, a value of an argument associated with the message as

parameter information the first time the value is encountered; and

(d) identifying, at the server, the value as algorithmic information each subsequent time the value is encountered.

7. The method of claim 6 wherein step (c) comprises:

(c-a) identifying, at the server, a value of an argument associated with the message as parameter information the first time the value is encountered; and

(c-b) storing a parameter identifier in a parametric sub-stream.

8. The method of claim 7 further comprising the step of compressing the parametric sub-stream.

9. The method of claim 6 wherein step (d) further comprises:

(d-a) identifying, at the server, the value as algorithmic information each subsequent time the value is encountered; and

(d-b) storing an algorithmic identifier in the algorithmic sub-stream.

10. The method of claim 9 further comprising the step of compressing the algorithmic sub-stream.

11. The method of claim 6 further comprising the step of transmitting the algorithmic sub-stream.

12. The method of claim 7 further comprising the step of transmitting the parametric sub-stream.

13. An apparatus for extracting algorithmic information from a message stream, each message having associated arguments and each argument having an associated value, and transmitting the extracted information via a network connection, the apparatus comprising:

a transmitter in electrical communication with a network connection;

a memory element in electrical communication with said transmitter, said memory element providing storage for an algorithmic sub-stream and a parametric sub-stream;

an extractor in electrical communication with said memory element, said extractor separating a message having associated arguments into algorithmic information and value

information and storing the algorithmic information in an algorithmic sub-stream;

wherein said transmitter transmits the algorithmic sub-stream.

14. The apparatus of claim 13 wherein said extractor stores the value information in a parametric sub-stream.

15. The apparatus of claim 13 wherein said transmitter transmits the parametric sub-stream.

16. The apparatus of claim 13 wherein said memory element comprises a stack data structure.

17. The apparatus of claim 13 further comprising a compressor in electrical communication with said memory element and said transmitter, said compressor compressing the algorithmic sub-stream.

18. A system for extracting algorithmic information from a message stream, each message having associated arguments and each argument having an associated value, and transmitting the extracted information from a server to a client via a connection, the system comprising:

a client including:

a receiver in electrical communication with the connection, the receiver receiving algorithmic information transmitted over the connection; and

a server including:

a transmitter in electrical communication with the connection, the transmitter transmitting algorithmic information over the connection;

an extractor separating a message having associated arguments into algorithmic information and value information; and

a memory element in electrical communication with said extractor, said memory element storing an algorithmic sub-stream including algorithmic information separated by said extractor.

19. The system of claim 18 wherein said client further includes a client memory element in electrical communication with said receiver, said client memory element storing algorithmic and parametric sub-streams transmitted by said server.

20. The system of claim 19 wherein said client further includes an extractor in electrical communication with said client memory element, said client extractor producing the message from the algorithmic and parametric sub-streams.

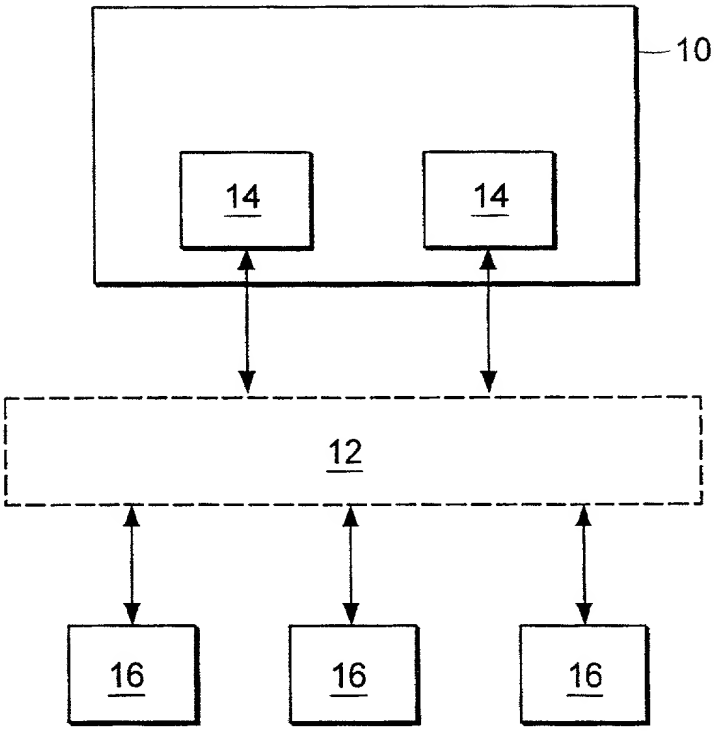

FIG. 1

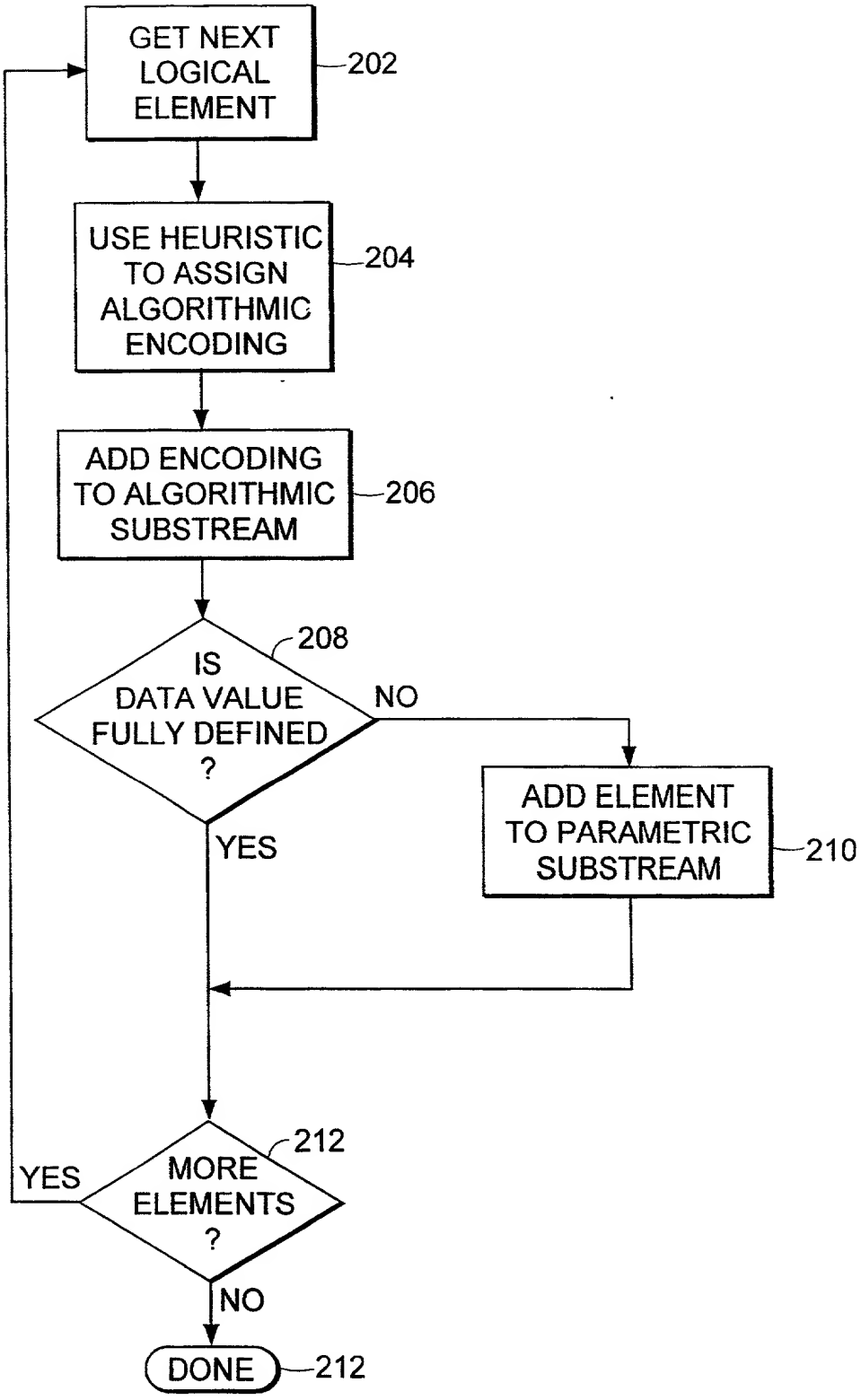
GET NEXT LOGICAL ELEMENT
202
USE HEURISTIC TO ASSIGN ALGORITHMIC ENCODING
204
ADD ENCODING TO ALGORITHMIC SUBSTREAM
206
IS DATA VALUE FULLY DEFINED ?
208
NO
YES
ADD ELEMENT TO PARAMETRIC SUBSTREAM
210
MORE ELEMENTS ?
212
YES
NO
DONE
212

FIG. 2

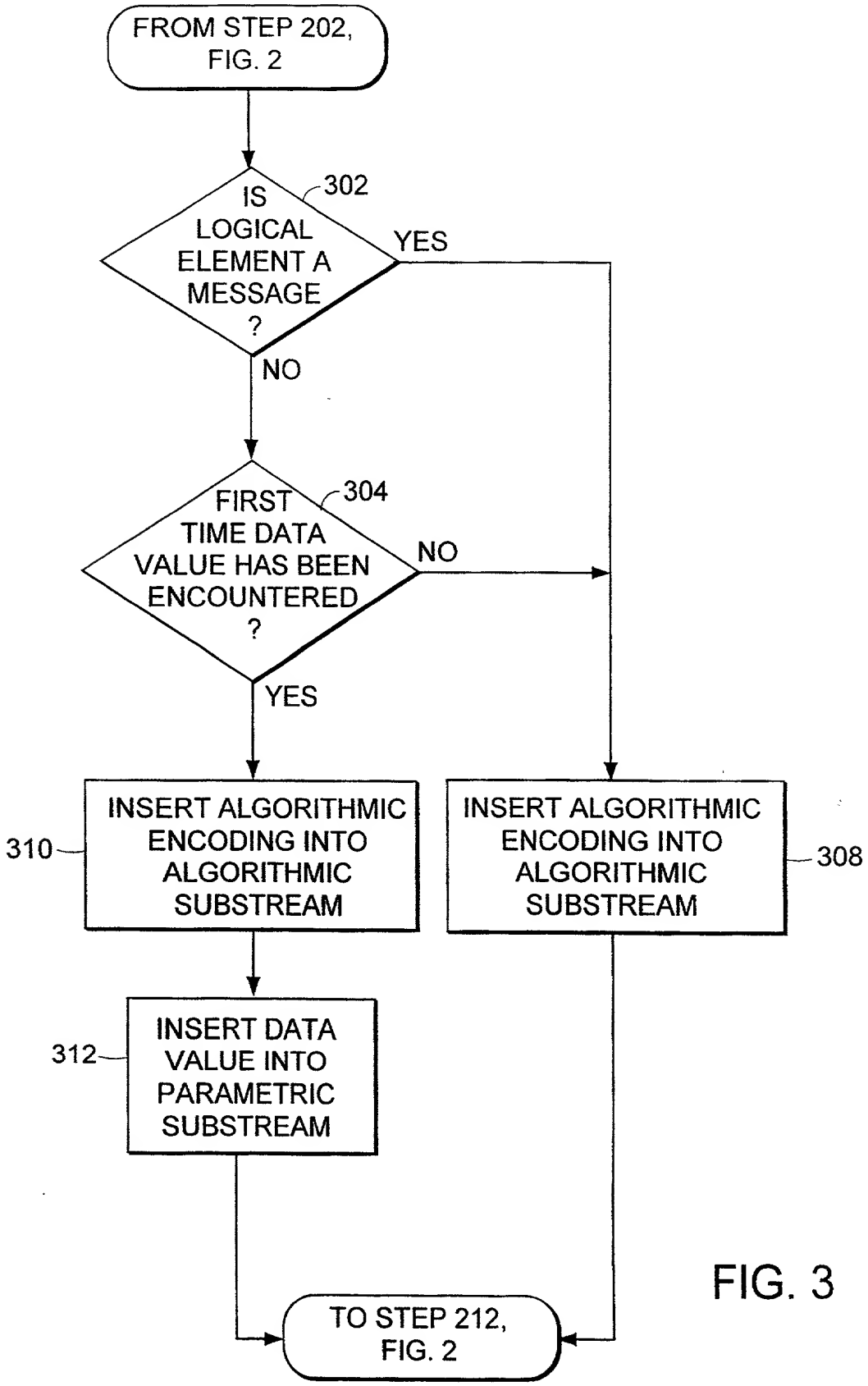
FROM STEP 202, FIG. 2
IS LOGICAL ELEMENT A MESSAGE ?
302
YES
NO
FIRST TIME DATA VALUE HAS BEEN ENCOUNTERED ?
304
NO
YES
INSERT ALGORITHMIC ENCODING INTO ALGORITHMIC SUBSTREAM
310
INSERT ALGORITHMIC ENCODING INTO ALGORITHMIC SUBSTREAM
308
INSERT DATA VALUE INTO PARAMETRIC SUBSTREAM
312
TO STEP 212, FIG. 2

FIG. 3

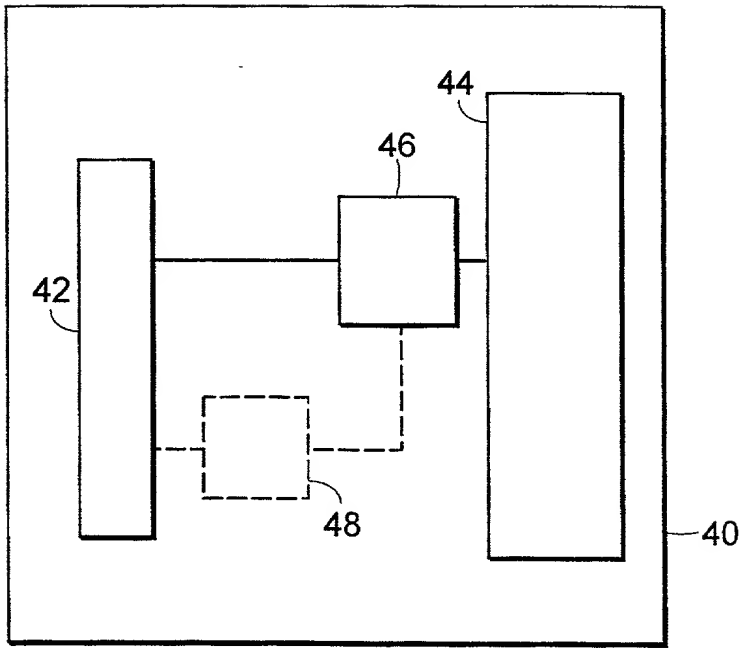

FIG. 4

Express Mail Label No. EL749105178US

DECLARATION AND POWER OF ATTORNEY FOR UTILITY OR DESIGN PATENT APPLICATION		
☒ Declaration Submitted with Initial Filing ☐ Declaration Submitted after Initial Filing (surcharge 37 CFR 1.16(e) required)	Attorney Docket No.	CTX-024 (1545/45)
	First Named Inventor	Collins
	COMPLETE IF KNOWN	
	Application Serial Number	Not Yet Assigned
	Filing Date	Herewith
	Group Art Unit	Not Yet Assigned
	Examiner Name	Not Yet Assigned

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Apparatus And Method For Extracting Algorithmic Information From A Message Stream

(Title of the Invention)

the specification of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) 08/04/1999 as United States Application Serial Number or PCT International Application Number PCT/US99/17611 and was amended on (MM/DD/YYYY) _____ *(if applicable).*

I hereby state that I have reviewed and understand the contents of the above-identified application, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose to the Patent Office all information known by me to be material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
PCT/US99/17611		08/04/1999	☐	☐	☒
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet attached hereto.

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Serial Number(s)	Filing Date (MM/DD/YYYY)	
60/096,620	**08/14/1998**	☐ Additional provisional application serial numbers are listed on a supplemental priority data sheet attached hereto.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor:	☐ A petition has been filed for this unsigned inventor						
Given Name (first and middle [if any])			Family Name or Surname				
Henry			**Collins**				
Inventor's Signature					Date	13 Feb 2001	
Residence	City **High Wycombe**	State **Bucks**	Country **Great Britain**		Citizenship	**Great Britain**	
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☐ Additional inventors are being named on the ____ supplemental Additional Inventor(s) sheet(s) attached hereto.							
Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor						
Given Name (first and middle [if any])			Family Name or Surname				
Inventor's Signature					Date		
Residence	City	State	Country		Citizenship		
Mailing Address							
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Name of Additional Joint Inventor, if any:	☐ A petition has been filed for this unsigned inventor						
Given Name (first and middle [if any])			Family Name or Surname				
Inventor's Signature					Date		
Residence	City	State	Country		Citizenship		
Mailing Address							
Mailing Address (ln. 2)	City	State	ZIP		Country		

DECLARATION – Utility or Design Patent Application

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c), of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Serial Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number *(if applicable)*
PCT/US99/17611	08/04/1999	

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet attached hereto.

As a named inventor, I hereby appoint the following registered practitioners to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: ☐ Customer Number

OR

☒ Registered practitioner(s) name/registration number listed below

→ *Place Customer Number Bar Code Label Here*

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